national gas transmission

St Fergus Compressor Emissions Re-opener:

Unit 1A Asset Health Engineering Justification Paper

December 2025

Version: 1.0

Official-Sensitive Commercial

Version control

Version	Date of issue	Notes
0.1	October 25	First Draft (without cost estimates)
0.2	December-25	NGT Second Draft (With Cost estimates)
1	December- 25	Ofgem Submission

Contents

1 Summary Table

[redacted]

[1] For RIIO-T2 the direct costs aligned to CEPOt represent the allowances requested, as this project is subject to the Opex Escalator (Special Condition 3.18 of the Licence). For RIIO-GT3 and RIIO-GT4 our funding request under CEPOt includes direct and indirect cost.

2 Executive Summary

Whilst the investments proposed in this submission have been developed to a 25-year Asset Health re-life strategy, given the cost increase as set out in the provided Cover Letter we will explore a phased approach for critical Asset Health investments to ensure the best outcomes for consumers while improving unit availability across this critical site by March 2026.

Background

2.1.1 This submission seeks funding to address Asset Health needs on Unit 1A at the St Fergus Gas Terminal. The proposed interventions are aligned with our previously submitted St Fergus Site Strategy (Appended with the cover note) and are necessary to ensure the continued safe, secure, and reliable operation of the UK Gas National Transmission System (NTS).

2.1.2 This Engineering Justification Paper (EJP) sets out the engineering case, scope, delivery plan, efficient costs and the requested regulatory allowances for Asset Health interventions for St Fergus Unit 1A. The purpose of these interventions is to enable Unit 1A to provide reliable, safe service under the Medium Combustion Plant Directive (MCPD) Emergency Use Derogation (EUD) from 1 January 2030. This derogation will limit the usage of the unit to a five-year rolling average of 500 run hours per year.

2.1.3 In November 2023, Ofgem approved NGT's Compressor Emissions Final Preferred Option[2] which includes the installation of three new gas turbine driven compressor units of approximately 15MW output power to be commissioned by 2030. In addition, one of the existing [redacted] (previously referred to as [redacted] will be retained with significant asset health investment to improve unit availability.

2.1.4 This EJP details the proposed asset health investment for the Unit which will be retained. Proposals related to the new units will be covered in a separate EJP to be submitted in 2026. This document should be read in conjunction with the St. Fergus compressor emissions reopener submission cover letter, St. Fergus Site Strategy and attached appendices.

Process

2.1.5 St Fergus Unit 1A was selected as the most appropriate unit to retain long-term. This was based upon a combination of condition and location to best facilitate the construction of the new units whilst maintaining site operation.

2.1.6 To assess the condition of St Fergus Unit 1A, a Remnant Life Study (RLS) was conducted. This analysis provided insight into the remaining operational life of key components and highlighted areas of deterioration. The findings helped to identify specific asset health issues and underlying problems affecting reliability and performance. This is detailed in the Problem Statement section.

2.1.7 A range of intervention options were considered including do nothing, minor refurbishment, major refurbishment and replacement. Options were assessed using a data-driven approach to assess the relative merit of alternative interventions (see Options Considered)**.**

2.1.8 To avoid any duplication, a comparison was done to the RIIO-GT3 Business Plan and previous submissions, the results of which are presented within the Intervention portfolio document.

Request

2.1.9 NGT considers all interventions as proposed within this EJP essential within the next six years. Deferral would fail to address personnel safety risks, or integration risks from mixed technologies and would not deliver the availability uplift of Unit 1A required to strengthen site resilience and ensure we can continue meeting required gas volumes and pressures.

2.1.10 NGT requests a re-opener direction from Ofgem to modify outputs, delivery dates and associated allowances (CEPOt) of [redacted] 2018/19 price base) across RIIO-T2, RIIO-GT3 and RIIO-GT4 price control periods to deliver the proposed asset health interventions by 2032. The project is at Network Development [redacted] and the cost estimate provided as part of this submission is a bottom-up estimate with [redacted] – see Appendix B.

2.1.11 The delivery programme to deliver this work ahead of the MCPD legislative deadline of 1 January 2030 is contingent upon NGT entering financial supply chain commitments and contract award by August 2026. The internal governance requires clarity of the regulatory position prior to such commitment. As such, NGT requests that Ofgem assess this application in line with its Standard Assessment Tier, with an estimated time from point of submission to decision of 3-6 months. Accordingly, NGT request that Ofgem target Draft Determination (DD) by 31 July 2026 and Final Determination (FD) by 31 October 2026. This is aligned with Ofgem's re-opener guidance, paragraph A11.21. NGT is keen to support Ofgem in their review process to permit a timely decision.

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[2] https://www.ofgem.gov.uk/decision/decision-st-fergus-compressor-emissions-final-preferred-option

3 Introduction and Funding Request

3.1.1 The St. Fergus gas terminal ensures the continued entry of UK Continental Shelf (UKCS) and Norwegian gas into the National Transmission System (NTS) by providing the compression capability required to manage highly variable flows from the North Sea Midstream Partners (NSMP) sub-terminal, which can range from [redacted] This capability is critical to maintaining UK security of supply and supporting the flexibility needed to respond to changing market conditions.

3.1.2 This Engineering Justification Paper (EJP) follows the Ofgem-approved Final Options Selection Report (FOSR) submission for the St. Fergus Gas Terminal (Appended with submission cover note) to comply with the MCPD emissions legislation. The FOSR provided a summary of all the work performed to evaluate, cost and analyse a suite of feasible options available to maintain current levels of network capability and availability for customers.

3.1.3 This EJP covers Asset Health interventions on the existing Unit 1A to address defects, obsolescence and safety/compliance gaps and thereby extend operational life to 2050 in an EUD role (≤ 500 hrs/yr post 2030). It does not cover the installation of new units (brought forward separately through St. Fergus New Units EJP with draft submission in December-2025 and final update in March-2026 as agreed with Ofgem).

3.1.4 Figure 1 below shows a general view of the St. Fergus Gas Terminal and plant wise unit status.

[redacted]

3.1.5 To ensure the most robust and cost-effective approach for improving the operational condition of Unit 1A and securing reliable performance beyond 2030, NGT adopted a structured, evidence-based process. NGT engaged a Main Works Contractor (MWC) with proven experience in similar interventions to undertake a comprehensive assessment of Unit 1A. This ensured that the evaluation was informed by industry best practice and supported by specialist technical knowledge.

3.1.6 In May 2025, Electrical and Mechanical Asset Health surveys (Appendix F) were completed by the MWC under close supervision of NGT-appointed Subject Matter Experts (SMEs), which included discipline specific SMEs and site-based technical SMEs. These surveys provided granular insights into the current condition of critical components, identifying areas of deterioration and potential failure risks.

3.1.7 Following the surveys, NGT convened a series of structured workshops involving internal stakeholders and MWC representatives. These sessions were designed to rigorously challenge the findings, validate assumptions and ensure that proposed interventions were both technically justified and aligned with long-term reliability objectives.

3.1.8 Feedback from these workshops was consolidated by NGT SMEs, and NGT's execution team in collaboration with the MWC [redacted] and their sub-contractor [redacted]. This iterative process ensured that the final scope represents the most economic and efficient solution, balancing operational resilience with value for money for consumers with this time sensitive investment. The agreed works are targeted to extend the life of Unit 1A beyond 2030. This has the added benefit of extending the whole asset life by 25 years and deliver reliable operations until 2050.

3.1.9 NGT has ensured robust governance, stakeholder engagement, and cost efficiency throughout the process of scope development of this submission, while also ensuring that every element of the proposed intervention delivers maximum benefit for consumers and aligns with regulatory expectations.

3.1.10 Options such as refurbishing and selectively replacing critical mechanical and electrical equipment supporting the unit were explored, along with the impact of such interventions on the Unit's availability and terminal resilience to make an informed decision on investment (further discussed in Options Considered).

3.1.11 NGT also commissioned a comprehensive Reliability, Availability and Maintainability (RAM) study to understand the impact of the covered Asset Health scope on the Unit's availability and benchmark the same against NGT's internal standard to scale the impact of the planned investments. This is further discussed in section 5.1.5 .

3.1.12 From 1 January 2030, Unit 1A will be required to operate under the MCPD Emergency Use Derogation (EUD) (≤ 500 hrs/year, 5 years rolling average) and will provide limited hour resilience alongside the new units and VSDs.

3.1.13 Proposed interventions are essential for this Unit to support system availability and site resilience until 2050. Deferral would increase exposure to personnel risk, or integration risks from mixed technologies and would not realise the targeted availability uplift.

3.1.14 This EJP interacts with other documents to form the St. Fergus re-opener submission pack as illustrated below in Figure 2 .

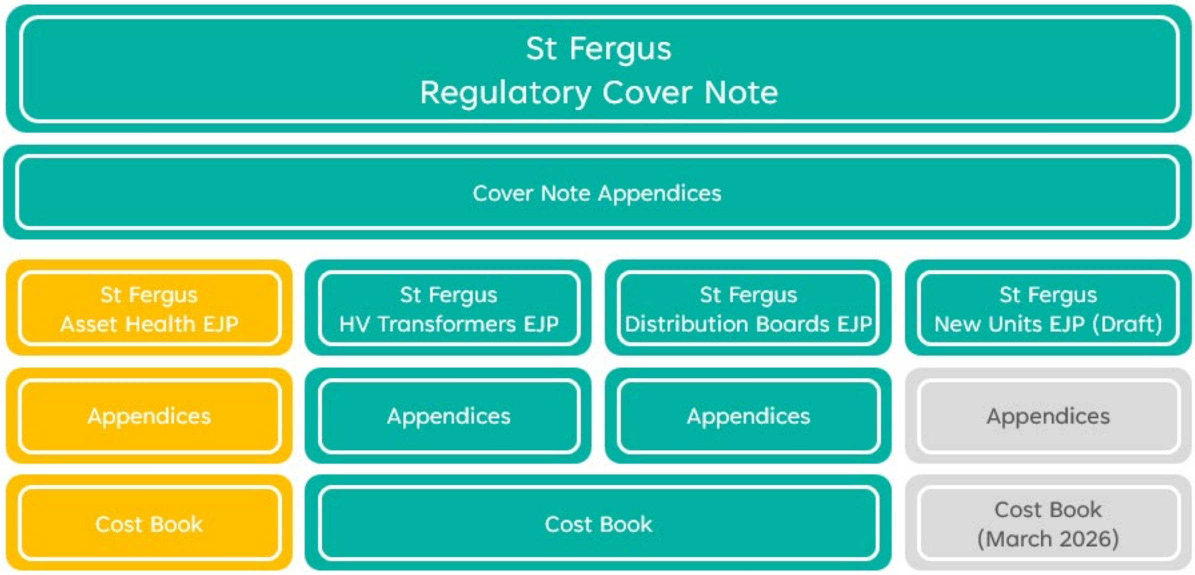


Figure 2: St. Fergus MCPD Unit 1A submission coverage highlighted and outlined

Request Summary

3.1.15 This submission is made in accordance with Special Condition 3.11, Part D and requests to modify the outputs, delivery dates and allowances in Appendix 2 of the Gas Transporter Licence (the Licence), which are detailed in Tables 2 and 3. Our total funding request (CEPOt) to deliver the required Asset Health works at St Fergus Unit 1A is [redacted] Ofgem are invited to assess and approve our cost proposal for the St Fergus Asset Health works in line with Special Condition 3.11, Part F.

3.1.16 Table 2 sets out the total funding request to deliver the Asset Health scope at St Fergus. Further details are included within the cost book (see Appendix B). For RIIO-T2 the direct costs aligned to CEPOt represent the allowances requested, as this project is subject to the Opex Escalator (Special Condition 3.18 of the Licence). For RIIO-GT3 and RIIO-GT4 our funding request under CEPOt includes direct and indirect cost aligned to Ofgem's published Final Determination for RIIO-GT3.

[redacted]

Price Control Deliverable

3.1.17 Table 3 provides a summary of the proposed Price Control Deliverables (PCD) Output associated with the delivery of the proposed re-opener scope for St Fergus Unit 1A.

[redacted]

4 Equipment Summary

Unit 1A

4.1.1 Commissioned in 1977, Unit 1A is a gas-powered compressor machinery train (CMT) which provides resilience when the lead, electrically driven Variable Speed Drive (VSD), units are unavailable during planned and unplanned outages. Unit 1A is also required to ensure adequate capability to support flows outside the range of the VSDs.

4.1.2 Figure 3 below shows the gas generator installed in St Fergus Unit 1A. The [redacted] is an aero-derivative gas turbine (GT), meaning it was originally developed from an aircraft engine design and adapted for industrial use. [redacted] are commonly used in power generation and mechanical drive applications, such as driving compressors and pumps in the oil and gas industry.

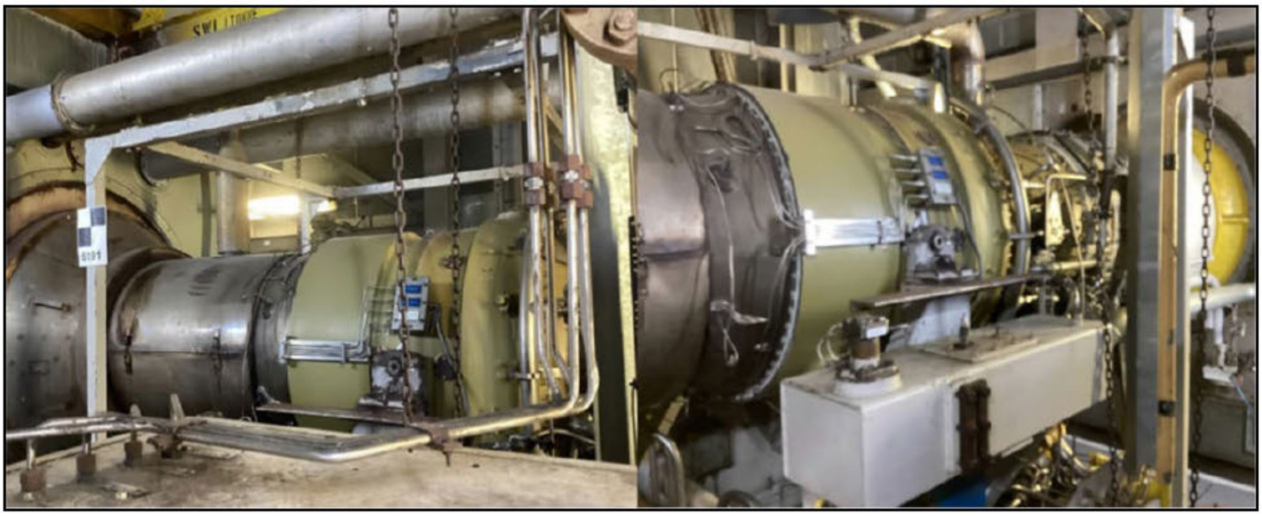


Figure 3: St. Fergus Unit 1A Gas Generator

Unit Selection

4.1.3 At the time of the St. Fergus FOSR submission, further investigation was needed to decide which unit would be retained. Therefore, analysis was conducted to determine which Unit should be modified based on several factors. Table 4 and the subsequent explanation sets out the rationale for retaining Unit 1A which is a candidate for a Dry Low Emissions (DLE) retrofit (subject to successful validation across the National Transmission System).

Consideration	Description
Asset Condition	Unit 1A is of a comparable condition to the other [redacted] with similar defects apparent across Plant 1.
Location	Decommissioning Unit 1B post-2030 (following operational acceptance of new units) will create a physical buffer between extant Unit 1A and new Unit 1C.
Balance of Plant	Two new units are planned for installation within Plant 2. Therefore, it is essential to maintain balanced resilience across both plants.

Table 4: Summary of Unit Selection Rationale

4.1.4 **Asset Condition** – Asset condition was a key factor in the decision-making process to ensure that any differences in the extent of refurbishment works required was accounted for. From assessing the defects across the prospective Units, it was determined that Unit 1A is in a comparable condition to the other [redacted] within Plant 1, such as Unit 1D and 1B.

4.1.5 **Location** – Figure 4 presents a high-level schematic of Plant 1 and Plant 2. It shows that retaining Unit 1A and decommissioning Unit 2B would reduce the probability of domino-effect in case of an emergency within one of the units (extant Unit 1A and New Unit 1C) had those been placed next to each other.

[redacted]

4.1.6 **Balance of Plant** – Maintaining balanced resilience across Plant 1 and Plant 2 is critical to ensure resilience and operational flexibility. Since [redacted] to replace [redacted] retaining Unit 2B was discounted. Instead, intervening on [redacted] This configuration reduces risk and supports overall system reliability.

4.1.7 Overall, Unit 1A was chosen as the preferred unit to retain beyond 2030 based on short- and long-term strategic requirements aligned to the St Fergus Strategy. Post-2030, following the asset health investment outlined in this paper, Unit 1A will continue supporting site resilience within its 500-hour EUD limit, providing essential flexibility for variable flow scenarios.

Unit 1A Auxiliary Equipment

4.1.8 The sustained safe, compliant and reliable operation of Unit 1A is dependent on the capability and asset health of all components/aspects of the compressor machinery train and the multitude of mechanical and electrical sub-assets. The following provides an overview of these assets and how they support the operation of the Unit.

St Fergus Unit 1A Mechanical Sub-Asset Summary

4.1.9 **Pipework** – The Unit 1A pipework comprises the suction, discharge, recycle (bypass) and vent/drain systems. The suction/discharge lines route gas through the compressor to achieve the pressure required for delivery to the NTS. Recycle and venting functions support-controlled rundown, emergency shutdown and safe degassing for maintenance.

[redacted]

4.1.10 **Pipe Covers -** Pipe covers protect the suction and discharge pipework where they interface with the compressor acoustic building (CAB). They prevent water ingress, reduce corrosion risk, and maintain enclosure sealing integrity. These covers also help preserve the structural and thermal performance of the piping system.

4.1.11 **Valves and Actuators** – Valves are essential to routine and emergency gas routing as well as for isolations to enable safe maintenance. To operate effectively and safely, valves must function as intended including opening/closing on demand with the ability to maintain seal as designed. Valve and actuators sub assets include mainline isolations, recycle, bridle valves and fuel gas valves, operated locally or via actuators as per the existing control philosophy.

[redacted]

4.1.12 **Non-Return Valve (NRV)** – The discharge side NRV provides directionality of flow and pressure segregation between systems during transient conditions, preventing reverse flow towards the compressor. Its role is integral to safe and reliable unit operation under a range of operating states.

4.1.13 **Isolation Valves** – For intrusive work, double block arrangements are used to provide isolation and vent down pressure. Unit 1A employs paired isolation valves with an atmospheric vent path to support the site's safe system of work requirements.

4.1.14 **Valve Actuation** – There are multiple process valves that support operations of Unit 1A including actuated suction and discharge valves. These actuated valves are critical for controlling gas flow during compressor operation, enabling remote or automated isolation and sequencing of suction and discharge lines. Their function supports safe start-up, shutdown, and operational flexibility of the gas compressor unit.

4.1.15 **Lube Oil System** – There are two lube oil systems (containing pumps, cooler, filters and bulk supply) associated with Unit 1A, one for the gas generator and one for the power turbine and compressor. Their purpose is to provide lubrication and temperature control to reduce excessive heat and friction. They are required during unit startup, normal running and rundown sequences and interface with associated monitoring and control elements. As such, they are critical for turbine and compressor operations and directly impact Unit availability.

4.1.16 **Seal Oil System** – Unit 1A utilises a seal oil arrangement to control process-side leakage and maintain the required differential across seals under operating and transient conditions. The system comprises pumps, conditioning hardware and associated instrumentation within the compressor CAB.

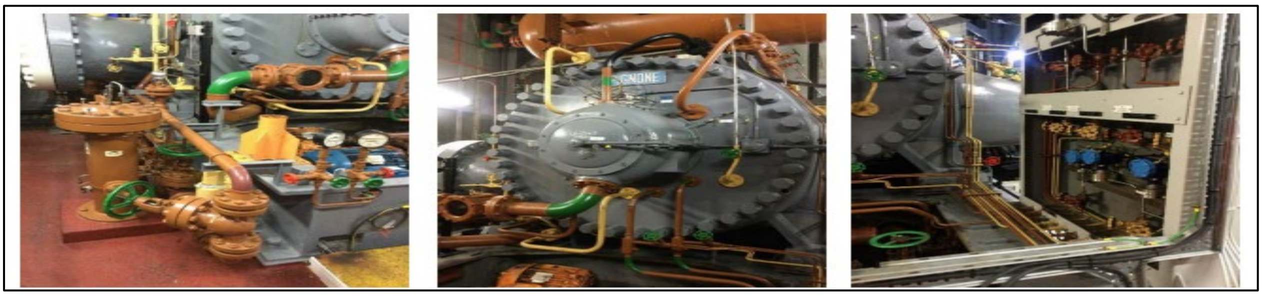


Figure 7: Lube and seal oil lines arrangements on Unit 1A

4.1.17 **Fuel Gas Supply Skid** – The fuel gas system provides the gas generator with correctly filtered and conditioned fuel at the required pressure/flow and temperature to protect equipment and maintain stable combustion across the operating envelope. System elements include filters, pressure control, and metering/valving.

4.1.18 **Exhaust Gas Collector –** The collector/transition connects the power turbine outlet to the exhaust stack inlet, directing hot combustion products from the power turbine to atmosphere via the stack, while accommodating thermal expansion through flexible elements.

4.1.19 **Exhaust Stack –** The multilayer stack provides the vertical discharge path to atmosphere for turbine exhaust. It includes acoustic attenuation features to support environmental performance. The stack arrangement is also used to support emissions sampling in line with applicable consents.

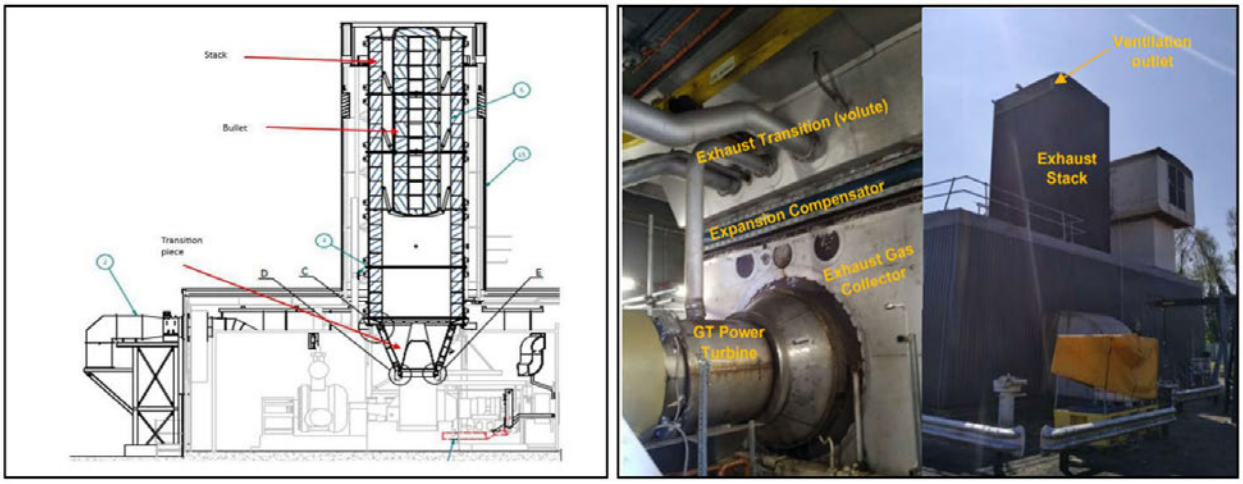


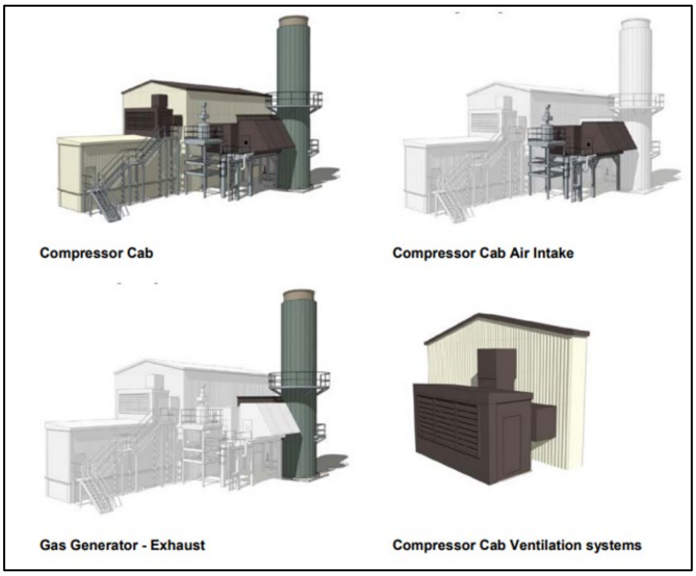
Figure 8: Exhaust stack and bullet arrangement for Unit 1A(Left) and a typical NTS site configuration of exhaust system(right)

Compressor Acoustic Building (CAB)

4.1.20 **Outer CAB -** The outer enclosure acts as the primary weatherproof barrier for Unit 1A. It shields the inner acoustic enclosure and associated piping from environmental exposure to mitigate corrosion risks and maintain controlled conditions for ventilation performance. There are various access points to facilitate maintenance and inspection activities.

4.1.21 **Inner CAB -** The inner enclosure houses the gas turbine and compressor, forming the main acoustic barrier to reduce noise emissions and maintain compliance with environmental standards. It also supports controlled ventilation and pressurisation, which are critical for safe turbine operation and for preventing the accumulation of hazardous gases.

4.1.22 **Air Intake System -** The air intake system supplies clean, filtered air to the gas turbine for combustion. It includes cowls, filter housing, mist eliminators, and access structures. Its role is to maintain airflow quality and prevent foreign object damage (FOD), ensuring efficient combustion and protecting turbine components from corrosion and debris ingress.



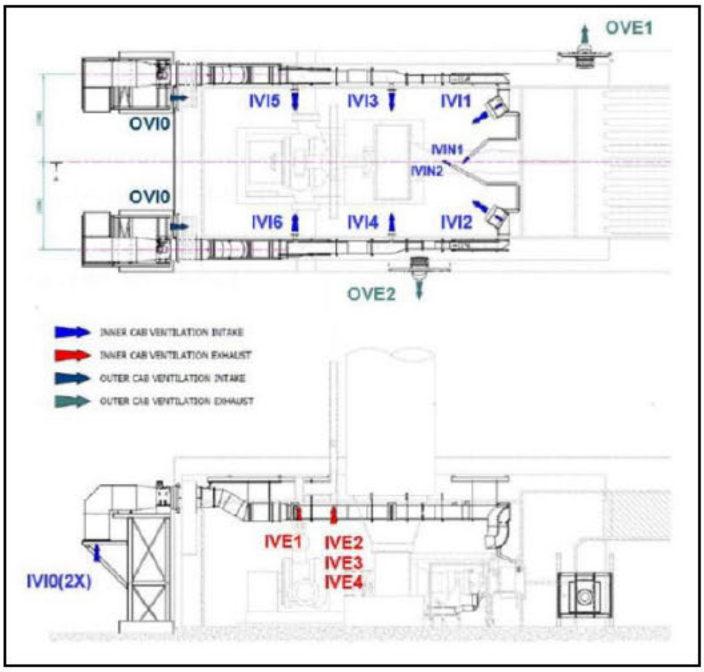


Figure 9: Unit 1A CAB components and Air Intake

St. Fergus Unit 1A Electrical Sub-Asset Summary

4.1.23 **Low Voltage (LV) Switchboards** – LV switchgear provides control, protection and isolation for electrical circuits feeding Unit 1A auxiliaries and safety related systems. Functions include de-energisation for maintenance, fault clearance and segregation of circuits and sources in accordance with the site electrical architecture.

[redacted]

4.1.24 **Motor Control Centre (MCC)** – The Unit 1A MCC houses starters, protection and isolation for motors serving unit auxiliaries (e.g., ventilation fans, oil pumps, coolers). It forms the central point for control power and interlocking for the compressor CAB's rotating and static ancillary equipment.

[redacted]

4.1.25 **LV distribution switchboard** – LV distribution switchboards (J1) provide sub-distribution, protection and isolation for lighting and small power circuits serving the compressor cab and associated plant areas, coordinating with upstream LV switchgear and the MCC.

[redacted]

[redacted]

4.1.26 **Motors** – Motors provide motive power for critical auxiliaries, including ventilation, oil systems and cooling services. The population is predominantly original with more recently installed ventilation units, with duty/standby philosophies applied where required by the functional design.

Figure 13 Illustration of typical motors serving Unit 1A

4.1.27 **Junction Boxes (JBs)** – LV armoured and MICC cabling connects the MCC/DBs to field devices via hazardous area certified junction boxes. DSEAR punch list items (e.g., seized glands, incorrect plugs, corrosion) and the age of original cables indicate that replacement of legacy cabling, trace heating JBs and selected field JBs is prudent to avoid hidden insulation defects during manipulation and to sustain safety compliance.

Figure 14: Representative junction boxes serving Unit 1A

4.1.28 **Cables** – Cables connect the LV MCC and distribution boards to field devices via local junction boxes. These circuits supply operational and safety critical systems which are essential for safe compressor operation and personnel safety. Degradation or failure of cables can lead to loss of critical systems.

Figure 15: Representative cable runs and trays supporting Unit 1A

4.1.29 **Lighting** – Internal and external lighting provides safe access and visibility for operations and maintenance. In line with current practice, sites utilise efficient lighting technologies and, where appropriate, sensor triggered external lighting to minimise light pollution at rural locations.

Figure 16: Current internal and external CAB lighting supporting Unit 1A

4.1.30 **Earthing and Lightning Protection** – Existing earthing and lightning protection arrangements include legacy components; lightning protection upgrades are required to align with T/SP/EL/50 and site infrastructure changes.

4.1.31 **Control Stations and Field JB Hardware** – Local control stations and hazardous area junction boxes interface between field devices and distribution/MCC equipment, supporting local operations and terminations in accordance with hazardous area classifications.

4.1.32 **Trace Heating and Plenum Light** – Trace heating assemblies maintain temperature in defined services; CAB plenum lighting provides maintainable access lighting within plenums in line with hazardous area requirements.

5 Problem Statement

5.1.1 In line with the decision[3] to install three new gas turbine-driven compressor units and retain one existing unit with significant asset health investment to improve availability, Table 5 presents the key drivers which will enable Unit 1A to support the new MCPD-compliant units and the existing VSD units beyond 2030 under its Emergency Use Derogation (EUD) role.

Driver Category	Description
Legislation and Standards	All systems, processes, assets and equipment associated with Unit 1A must comply with applicable legislation, standards and specifications. Examples include, but are not limited to: Primary legislation such as Health and Safety at Work Act 1974 and specific regulations including Pressure Systems Safety Regulations (PSSR), Electricity at Work Regulations (EAWR) 1989 and Management of Health and Safety at Work Regulations 1999 are all directly applicable to Unit 1A. NGT standards and policies stipulate maintenance regimes and equipment specifications such as T/PM/COMP/23 (specification for mechanical equipment on compressor installations) which, in turn, incorporates wider industry standards including API, ASME, IGEM, ISO, IEC and BS EN standards to ensure adoption of best practice from recognised industry bodies. For example, it defines that certain assets are required to be certified (i.e., ATEX certification) for equipment and protective systems intended for use in potentially explosive atmospheres as per Directive 94/9/EC.
Asset Deterioration	Without intervention, assets will continue to deteriorate, increasing the likelihood of failure with multifaceted consequences. Unit 1A has been in operation since 1977 and has been sustained through routine maintenance, overhauls, modifications, and upgrades – measures that have been vital to its continued service. Given the ongoing need for Unit 1A, it is essential to maintain this approach by addressing known defects and demonstrable deterioration to restore its condition to support functionality and capability in line with future strategy. Due to the complex interactions between Unit 1A and its associated assets and sub-assets, interventions must be considered as an integrated package of work.
Reliability and Availability	Unit 1A must remain reliable to meet required availability levels and support St Fergus resilience. Performance issues and defects directly impact availability and, therefore, require timely intervention. The Reliability, Availability, and Maintainability (RAM) study referenced in this EJP modelled the unit's performance under various scenarios to identify targeted investments needed across the compressor machinery train package.
Age and Obsolescence	Assets and sub-components installed on Unit 1A continue to become obsolete resulting in longer lead times for spares and repairs. In turn, this increases the risk of adversely impacting availability and therefore must be managed through intervention which is further highlighted by the RAM study.
Safety and Environment	The safety of people, plant and equipment must be managed appropriately in accordance with our Safety Case and COMAH responsibilities and as part of the absolute need to comply with HSE legislation. Assets, systems and processes must be assessed and action taken where necessary to ensure risks are understood and reduced to As Low as Reasonably Practicable (ALARP) across all aspects of Unit 1A. Furthermore, Unit 1A is required to operate in full compliance with environmental permits and adopt practices that minimise environmental impact.

Table 5: Investment Drivers Summary

5.1.2 Considering these drivers, NGT commissioned [redacted] to undertake a Remnant Life Assessment Study in 2023 which aimed to evaluate the condition, supportability, and remaining life of Unit 1A. Following this, [redacted] the pre-selected Asset Health Regional Framework contractor, carried out a detailed survey of Unit 1A and its ancillary assets.

5.1.3 This involved engaging specialist vendors to assess the baseline condition and identify the remedial works and/or modifications required to ensure the unit can continue to operate safely and reliably beyond 2030. This process also

[3] https://www.ofgem.gov.uk/decision/decision-st-fergus-compressor-emissions-final-preferred-option

included a study of the unit's baseline reliability, availability, and maintainability (RAM).

5.1.4 The asset health assessment is included in Appendix F, with Appendix A detailing the survey findings and defects in scope of this paper against the investment drivers shown in Table 5. The following sub-sections summarise the findings from the studies and surveys which involved the use of various techniques and data sources including:

- **Photographic Documentation** - High-resolution images were captured across the plant to visually document the current condition of equipment and infrastructure. These photographs provide a detailed record of visible signs of wear, corrosion, and deterioration.
- **Non-Destructive Testing (NDT)** - Advanced inspection techniques were utilised to detect flaws, cracks, corrosion, or structural issues that could compromise safety or performance.
- **Failure Impact and Criticality Analysis** - Assessing the impact of potential equipment failures on system reliability, safety, and overall plant operations.
- **Arc Flash Assessment using the Electrical Transient Analyser Program (ETAP)** - Arc flash hazard analysis was conducted to evaluate potential personnel safety risks on existing electrical equipment and ensure that appropriate protective measures were in place to mitigate safety concerns.
- **Insulation Resistance and Continuity Testing –** Specialist contractors conducted a range of electrical testing to ensure operational reliability and compliance with safety standards.

RAM Model

5.1.5 NGT, through the MWC, assessed the baseline reliability, availability and maintainability (RAM) of Unit 1A to outline the anticipated performance improvement post asset health investments. The RAM model was developed considering the following key points and assumptions:

- 25-year simulation was carried out with 500 Monte-Carlo runs, sufficient for stable statistics.
- Planned maintenance modelled as 14 days/year against the real- life situations leading to outage periods of 5/6 weeks every year.
- Operating pattern was assumed to include Future 500 hours/year utilisation, prorated to a realistic seasonal flow profile rather than flat running. Failures were split into Critical (100% loss) and Degraded (50% loss) modes; component failure/repair data mapped using OREDA (Offshore and Onshore Reliability Data) at maintainable-item level.
- At mid-life (year 12) the model halves MTBF (mean time between failures) for critical events to reflect obsolescence and restoration limits on a 50-year-old package.

5.1.6 Repair logistics were modelled including short, long, and obsolete-part lead-time distributions (up to 2,016 hours worst case).

5.1.7 [redacted]

5.1.8 T/PM/COMP/20 states that the failure of the machine to start on demand should occur less than once every 200 instructions. Data has reflected, Unit 1A had 239 successful starts out of 255, resulting in a start success rate of 93.7%. 16 failures to start out of 255 is a high number that puts the unit out of compliance.

5.1.9 Applying the proposed asset-health upgrades, increases availability to ~92.6% (+3.8 pp). Overall, however, the analysis shows that spares/logistics remain the binding constraint.

5.1.10 Table 6 presents a comparison of the baseline case vs use case from the study.

[redacted]

5.1.11 The outcome of the study has been used to inform the preferred option within the scope within this paper which targets the specific, model-dominant failure and delay drivers including:

- Fuel-gas conditioning (heater + PRA) to reduce failed starts
- Valve/actuators
- Electrical renewal to remove arc-flash risks

5.1.12 Together, these measures will address both the frequency and duration of the events the RAM study identified, providing the availability uplift required for resilient operations.

5.1.13 The detailed RAM model allowed NGT to make decisions on critical interventions and areas where NGT needs to invest time and money to make necessary upgrades on Unit 1A. Specifically, presents the reference case used to understand the contributing factors from a discipline-based perspective on Unit 1A's unavailability. This helped to direct the approach towards the key contributing areas and ensure the intervention is targeted and focused.

[redacted]

Mechanical/Structural Sub-Asset Health Survey Report Summary and Real-life examples

5.1.14 This sub-section presents a summary of the findings of the mechanical and structural aspects of the asset health surveys including examples to illustrate the current condition of Unit 1A. The full survey report included in Appendix F provides detailed findings.

5.1.15 **Pipework**- The suction, discharge, and recycle pipework exhibit significant corrosion, coating deterioration, and missing supports. Survey reports prepared in collaboration with MWC and NGT subject matter experts indicate that, if left unaddressed, these defects will worsen, increasing the likelihood of gas leaks, environmental non-compliance, and operational failures during peak demand. Progressive structural degradation could lead to costly emergency repairs and pose serious safety hazards. The pipework condition was assessed across three dimensions:

- **Internal Risk:** Based on fluid type and operating temperature.
- **Wall Thickness:** Green indicates acceptable thickness; Red signifies below design requirements.
- **Visual Condition:** A1 denotes imminent danger; C indicates satisfactory condition.

Based on the above criteria a R-A-G (red, amber and green) was assigned to different sections. For major pipework outside the CAB, 17 sections were evaluated, with over 50% falling into the Amber category under this assessment methodology. Conditions inside the CAB were found more severe, with majority of pipework classified as Amber or lower, highlighting a critical need for intervention (See section 10.1 of Appendix F).

Figure 19: Assessed Pipework for Unit 1A

5.1.16 **Pipe Covers -** Both suction and discharge pipe covers are in poor condition with severe deterioration of concrete bases. Frames are heavily corroded, with missing or torn seals and closure plates, creating water ingress paths. Adjacent cladding has been cut or modified, exposing bare steel and accelerating corrosion.

- **Discharge Pipe cover:** The assessment report mentions condition of concrete and channel base are in extremely poor condition, with severe blowouts and heavy delamination throughout.
- **Suction Pipe cover:** The frame is heavily corroded, with large breakaways and visible holes in the structure.

Figure 20: Condition of discharge pipe cover for Unit 1A

5.1.17 **Pipe Fittings (Tee connections) –** Fatigue issues have been identified in the suction and discharge piping. The report shows that five tees have calculated fatigue lives far below the required design life, with initial analysis indicating as low as 8.4 years and refined FEA confirming 4.6 years for the most critical tee. Without replacing these tees, the piping system will increase the likelihood of fatigue-related failures during operation. This could lead to unplanned outages and significant intervention later. If no action is taken, the fatigue issues identified will remain unresolved. Details of this assessment can be found within section 10.1.5 of Appendix F.

[redacted]

5.1.18 **Valves** - Valves supporting Unit 1A operations have exceeded their design life, exhibit corrosion, leakage, and coating degradation. Doing nothing risks failure to isolate systems, uncontrolled gas flow, creating safety hazards and operational downtime. Numerous mainline and skid valves are passing or at end-of-life risk.

5.1.19 **Lube Oil System** - Oil coolers and pumps show wear and corrosion, risking lubrication failure. High-temperature alarms indicate deteriorated performance. Doing nothing could lead to power turbine/compressor non-availability due to bearing damage and catastrophic compressor failure, hence leading to prolonged outages, long-lead time for pump spares (if found) and high repair costs.

Figure 22: Condition of Unit 1A Lube Oil System

5.1.20 **Fuel Gas Supply Skid -** Constructed in the 1970s, skid components face fatigue and obsolescence. Failure risks unsafe operation and inability to run the gas generator. Doing nothing increases the likelihood of unplanned downtime and compliance breaches.

Figure 23: Unit 1A Fuel Gas arrangement

5.1.21 **Fuel Gas PRA:** The existing PRA is not specific for Unit 1A and serves all the units within Plant 1. This arrangement will become oversized for Unit 1A post-2030, as Units 1B, 1C, and 1D are either decommissioned or scheduled for replacement by new units. The problem is further discussed within NGT_EJP27_St Fergus: Rotating Machinery_RIIO-GT3 submitted within the RIIO-GT3 business plan. Ofgem's position within final determination clarifies that the needs case for this issue is accepted.

5.1.22 **Fuel Gas temperature:** Currently the Unit is exposed to the risk of low fuel gas temperatures and associated operational limitations. Water bath heater used to provide optimum temperature has failed and the extended distance from the current fuel gas header to the turbine inlet have contributed to low fuel gas temperatures. This arrangement limits flexibility by proving minimal control to fuel gas temperature.

5.1.23 **Exhaust Gas Collector –** Severe corrosion and cracking are present which are beyond economic repair. Failure to this will allow hot exhaust gases into the enclosure, triggering shutdowns and presenting significant safety hazards. Continued deterioration could lead to structural collapse and environmental breaches.

5.1.24 **Exhaust Stack and bullet -** Original stack and bullet components are badly corroded. Failure compromises emissions sampling and noise attenuation, breaching environmental legislation and planning conditions. Structural integrity issues pose potential safety risks.

- **External condition assessment of stack:** Cracked welds observed on the return trim near the exhaust cowl. Earth bonding (Lightning protection) banding is loose.
- **External condition assessment of the bullet:** Various defects were found: - Damaged welds across perforate joints - Minor warping at weld joints on the bullet perforate, indicating thermal stress effects.
- The overall exhaust system was thoroughly assessed. Further details on the condition of the outer cowl, cladding, steel framework, combustion exhaust support structure, transition piece, exhaust hatch, and staircase can be found in section 5.1.2 of Appendix F.

Figure 24: Unit 1A Exhaust and bullet: Pictures show broken weld in the cowl

5.1.25 **Air Intake -** The air intake structure is in poor condition. Cowls and concrete plinths are cracked and deteriorated, with previous repairs failing. Baseplates of intake columns show severe corrosion and delamination, suggesting potential structural risk. The FOD (Foreign Object Damage) mesh is corroded and sagging, and access stairs are unsecured, propped with temporary supports. Filter house roof panels exhibit heavy corrosion from standing water, and localised corrosion is present on wall panels and fixings. Evidence of ferrous cross contamination and debris accumulation further threatens long-term reliability.

- The air intake system was assessed on a component-by-component basis such as filter and mist eliminator, filter house exterior, Intake house, access, Intake FOD mesh, and support steel work cowl. Details of this assessment can be found in section 5.1.5 of below Appendix F .

Figure 25: Unit 1A Air Intake: Pictures depicting corroded FOD mesh and baseplate fixing

5.1.26 **CAB ventilation computational flow dynamics (CFD) modelling-** CFD analysis was conducted to measure ventilation efficiency, identify stagnant airflow zones and highlight any gas leak safety issues. The study successfully validated airflow distribution, assessed hazardous gas dispersion risks and informed optimal placement of gas detectors. It highlighted the need to modify LEL setpoints to conform to safety margins within the CAB. High noise levels were identified at the Exhaust Vent, which need to be rectified during the CAB cladding replacement. Importance of CAB sealing was also noted in the study. The overall assessment was carried out to conform to BS ISO 21789:2022 compliance.

5.1.27 **Outer CAB –** It was confirmed that the cladding of the outer cab contains asbestos. Although the asbestos is encapsulated using painting, the underlying issues such as that leading to excessive noise at the exhaust vent (as noted in the MWC report) and going out of compliance of Control of Noise at Work Regulations 2005 can only be rectified by intrusive intervention and removing existing cladding. The exterior shows general weathering and impact damage. Access doors exhibit severe corrosion and poor sealing, compromising pressurisation and insulation. The roof has visible previous patch repairs; its condition indicates poor drainage and structural vulnerability. Steel framework behind the cladding is largely inaccessible but expected to need localised fabric maintenance and recoating once exposed.

Figure 26: Unit 1A Outer CAB: Pictures depicting hole in the lined panel and submerged baseplate

5.1.28 **Inner CAB –** The acoustic panels installed in the inner enclosure show signs of corrosion, particularly near ventilation inlets and outlets, and some fixings are missing. Severe corrosion is present on the north-side front wall panel, with a large hole in the lined panel. Evidence of water ingress on the inner roof and pooling at steel baseplates suggests drainage issues. Internal doors are functional but show light corrosion and loose hinge pins. The engine removal door latches are not fully engaged, reducing sealing integrity.

Figure 27: Unit 1A Inner CAB: Depicting corroded panels surrounding vent cascade and escaping gasket from engine to volute

5.1.29 **Fire Suppression-** When inspected by a specialist sub-contractor, the findings highlighted that the existing Marioff Hi-Fog water mist system fails compliance with NFPA 750 and NGT standards due to inadequate discharge duration (≈4 minutes vs. 10 minutes required) and nozzle coverage.

Figure 28 29: Unit 1A Fire suppression system cabinet (Interior and exterior)

Gas Turbine Non-Compliance

5.1.30 **Dehumidification -** The current air intake system lacks dehumidification capability. Without dehumidification, moisture ingress can lead to internal corrosion, icing, and accelerated wear of compressor blades, reducing efficiency and reliability. The existing gas generator air intake does not include a Shut Off Damper (SOD), and so at present, there is no means to isolate the generator and generator intake plenum from external ambient wind pressure and humid air. NGT standard T/SP/COMP/33 Section 7.1.4 outlines a requirement for turbines to be fitted with a dehumidification system when the units are to be in extended periods of standby. As Unit 1A is meant to be derogated to a maximum of 500 hours post 2030, this protection becomes a necessity.

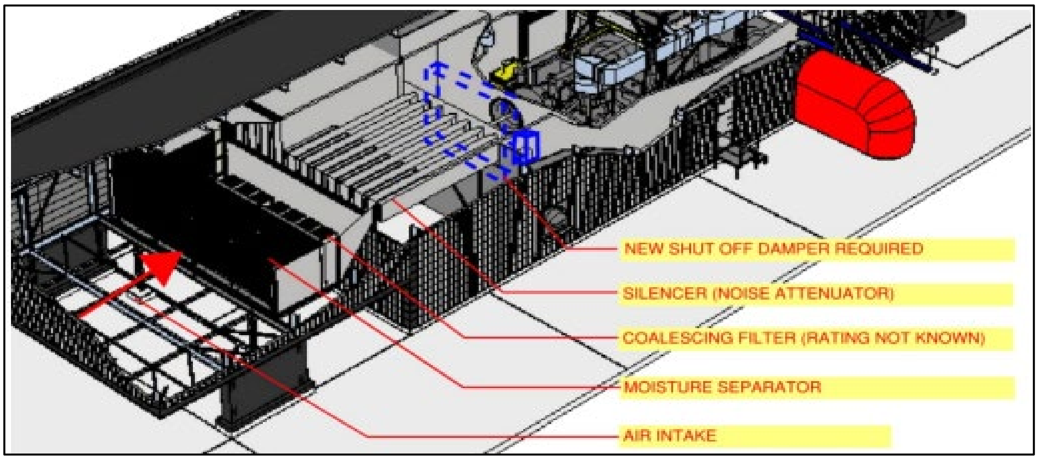


Figure 30 depicting Unit 1A lacking shut-off damper used for dehumidification (used for isolating generator and generator intake from external wind pressure)

5.1.31 **Blade-off Protection-** Unit 1A is currently non-compliant with the requirements stated within T/SP/COMP33, since it was designed before the inception of BS ISO 21789, which requires a compressor casing itself to contain a blade-off event. Absence of blade-off protection exposes the unit to catastrophic rotor failure, which could result in severe damage to surrounding equipment, extended outages, and significant personnel safety hazards. Doing nothing increases the likelihood of personnel injury, unplanned downtime, environmental non-compliance, and costly emergency repairs.

Gas Turbine /Compressor foundation assessment

5.1.32 The initial non-intrusive assessment indicated that gas turbine and compressor foundations are in good condition, with a low risk of corrosion. However, the need for an intrusive testing was confirmed within the non-intrusive survey report. An intrusive test on operational units (Unit 1A) was deemed too high-risk, and full inspection of external areas around air intake support columns could not be carried out due to poor weather conditions at the time of testing to finalise assessment results.

Electrical Sub-Asset Health Survey Report Summary and Real-life examples

5.1.33 This sub-section presents the key findings from the electrical asset health surveys including examples that illustrate the current condition of Unit 1A. The full survey report (Appendix F) provides detailed findings on the current condition of the electrical sub-assets which are essential to the ongoing safe and reliable operation of Unit 1A.

5.1.34 **LV Switchgear** -Plant 1 LV switchboard D1 ([redacted] installed in late 1970s) and integral boards are already planned for renewal within the RIIO-GT3 regulatory period. Deferral will prolong arc-flash and reliability risks across the 415 V distribution feeding the compressor CAB. Such electrical equipment poses risk to personnel, and any reportable incident would incur NGT penalties from HSE or even prosecution.

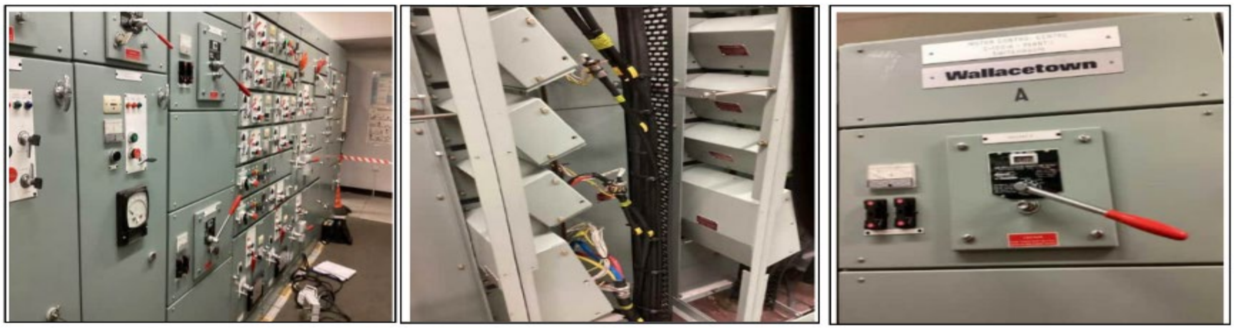


Figure 31: Unit 1A LV Switchboard D1 (Interior and Exterior)

5.1.35 **Motor Control Centre (MCC)** – Original Wallace town assembly (circa 1975) MCC E1 lacks Original Equipment Manufacturer (OEM) support and spares are unavailable. In addition to being obsolete, this MCC does not meet current BS EN 61439/TR61641 standards and presents arc-flash risks which is a significant safety risk to personnel operating the equipment. This also results in operational inefficiencies which are compounded by the growing maintainability and reliability issues. Any incident on such an equipment could result in penalties from HSE in case of reportable incidents which eventually will lead to a reputational loss and even prosecution.

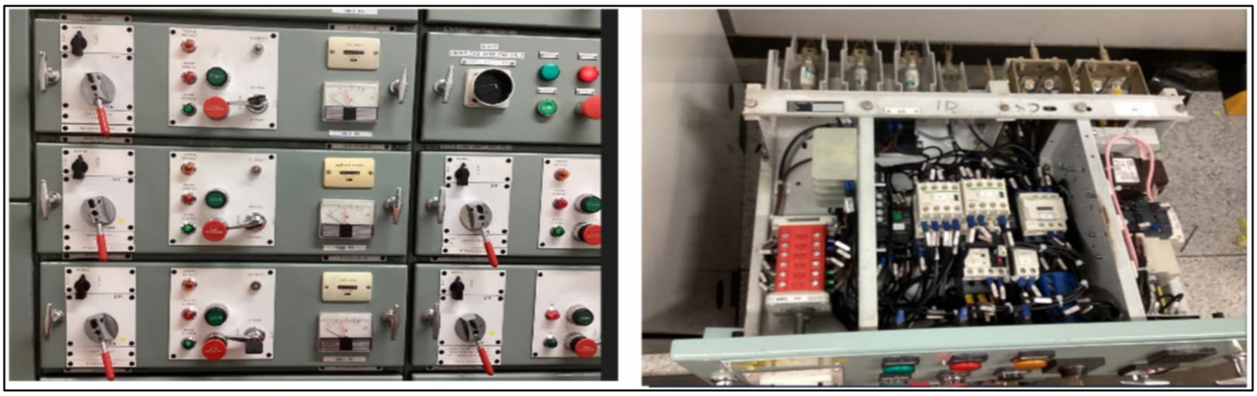


Figure 32: Unit 1A MCC (Interior and Exterior)

5.1.36 **LV Distribution switchboard -** The existing distribution switchboard J1 do not comply with modern segregation and arc-containment requirements (as highlighted within the Arc-flash study report). Furthermore, the existing OEM is no longer in business and assets are unsupported. Continuing with obsolete boards elongates the mean time to repair (MTTR) which increases availability risk.

5.1.37 The electrical assessment included an obsolescence review with OEMs to look at options for retaining in service (with selected component replacement/upgrade) and procurement and installation of new, current generation distribution boards to replace the existing boards. The obsolescence risk was measured and deemed to be high, particularly with some specific components and, as a result, the MTTR would be unacceptably long.

Figure 33: Unit 1A Individual distribution board within J1(Interior and exterior)

5.1.38 **Motors –** Insulation resistance tests indicated aging and deterioration of the insulation which could pose a risk to continued operation. DSEAR inspections have highlighted issues regarding the terminations of the power and earthing connections. Additionally, the original motors are not certified to current ATEX standards which contravenes asset specifications. Combined with the running hours of some of the motors being beyond the typical design life for induction motors, doing nothing risks recurrent starts/stops, overheating, insulation failures, and unplanned outages that compromise Unit readiness and availability. The critical role of motors within the lubrication systems installed on the compressor machinery train means that failure would present a serious risk of machine damage / failure, unplanned downtime and safety hazards. The MWC report also highlights specific issues which may arise during intervening on motors and pumps including:

- Assembly compatibility- Motor and pump are integrally coupled. Replacing only the motor introduces misalignment risk and compatibility issues, especially with mounting and shaft alignment.
- New motors only may exceed performance tolerances of existing pump (e.g., torque delivery, rotational speed variances).
- Operational risks of partial replacement
- Increased Downtime: Potential for pump failure shortly after motor replacement, leading to repeat shutdowns and lost operations.
- Reduced System Efficiency: Mismatched components can lead to operational inefficiency, vibration, and premature wear.
- Health and Safety Concerns: Leaking seals and overheating risks create hazards for maintenance personnel and nearby systems.

- Hidden Costs: Partial replacement might require multiple rework interventions and additional alignment labour at increased whole life cost.

5.1.39 **Cables –** Original PVC/SWA/PVC feeders and extensive MICC within the CAB have been in service 45+ years with insulation resistance tests showing lower readings for certain cables. Due to MCC/switchboard renewals, legacy cable systems will be mismatched in length, termination, and performance. Retaining aged cabling limits compliance, hinders new board layouts, and can elevate arc-flash clearing times.

- The risk associated with cables was determined by multiple check points such as a comprehensive visual assessment checklist (to determine impacts of ageing, labelling and condition), compliance checks (DSEAR assessment records) and insulation resistance test records. Details of this assessment are available within section 6.7.2 of Appendix F . The floor tiles and tiles covering the cables serving Unit 1A have been identified to contain asbestos, so direct access is restricted; however, some cales were visually inspected.

5.1.40 **Lighting –** Fluorescent luminaires are weathered, obsolete and do not comply with current specifications. Assets were identified which are non-compliant with safety standards, including DSEAR 2002 which requires lighting and protective systems to meet the Equipment and Protective Systems for Use in Potentially Explosive Atmospheres Regulations 1996. Lighting systems must be maintainable and operable to ensure they can serve dual purposes, operating as normal lighting under regular conditions and as emergency lighting during crises, with emergency systems meeting standards like BS 5266-1 and non-emergency lighting conforming to BS EN12464-1. Persisting with legacy fittings degrades maintenance efficiency, increases failure risk, and leaves Unit 1A non-compliant for safe access/egress during faults or outages. The risk associated with lighting assets was determined by multiple check points such as a comprehensive visual assessment checklist (to determine impacts of ageing, labelling and condition), compliance checks (DSEAR assessment records), lighting test records.

Figure 34: Typical Unit 1A lighting

5.1.41 **Earthing and Lightning Protection (LP) -**The report evaluated earthing/LP as a specific assessment. Failure to verify and remediate earthing continuity/impedance and lightning protection integrity can increase touch/step voltages and equipment damage risk during faults/transients. Findings of the earthing conductors, bars, and bonding connections which are original from the mid-1970s included multiple areas where earthing system show signs of extensive corrosion, and signs of earlier refurbishment works which have increased bonding resistance. It was also noted that earthing arrangements will require disconnection, removal of existing earthing components and remake of joints during civil refurbishment proposed within this submission which may lead to further deterioration of the earthing system and add uncertainty to reliability of the system overall.

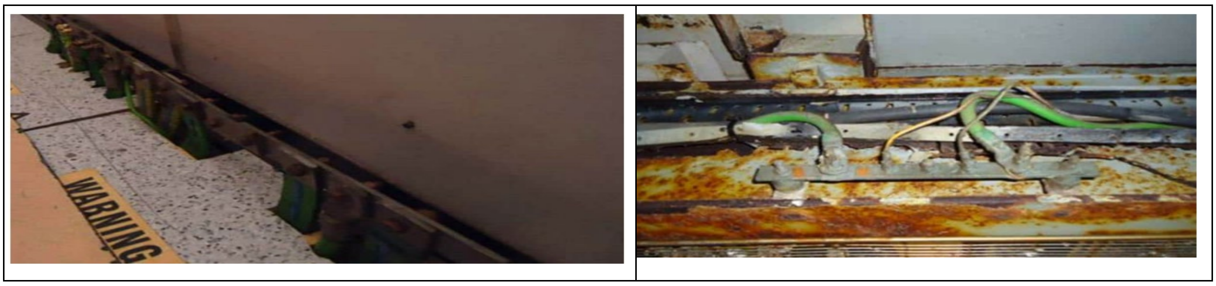


Figure 35: Condition of typical earthing supporting Unit 1A

5.1.42 **Arc Flash Assessment** – An arc flash is a rapid release of energy from an electrical arc (between live conductors or live to earth), producing intense heat, pressure, light and sound. The energy released in an arc flash event can eject molten metal and shrapnel, generate toxic fumes/smoke, and cause severe injuries (burns, blast trauma, hearing loss, vision damage) or death for personnel in proximity. Appropriate engineering controls, operating procedures, and fit for purpose PPE are therefore always required when working on or near energised equipment.

5.1.43 [redacted] performed an arc flash study for Unit 1A's associated panels (MCC C1201A (E1), LV switchgear D1/J1, selected field boards) to calculate incident energy and PPE category requirements in accordance with NFPA 70E. Under the Electricity at Work Regulations and the Management of Health and Safety at Work Regulations, employers must assess and reduce electrical risks so far as reasonably practicable including arc flash hazards.

5.1.44 Based on the assessment and information collected at site, the Electrical Transit Arc Protection (ETAP) power system analysis software indicated that flash incident energy levels vary depending on the incoming utility supply, with certain electrical assets being identified as high risk. If switchboards are renewed to BS EN 61439 and tested to TR 61641 for arc fault containment, the residual arc flash risk and PPE burden will be reduced to As Low As Reasonably Practicable (ALARP).

What the investment seeks to achieve

5.1.45 The problems identified from the detailed surveys and RAM study clearly demonstrate the need to invest in Unit 1A This intervention is essential to ensure Unit 1A remains a dependable backup asset, capable of supporting network resilience and aligning with the St Fergus site strategy to achieve compliance with the MCPD directive.

5.1.46 Mechanical and structural assets have been proven to have significant corrosion, coating deterioration and compliance gaps that pose risks of catastrophic failure, environmental breaches, and safety hazards if left unaddressed. Certain electrical systems that support Unit 1A are no longer suitable from a personnel and equipment safety perspective as they are non-compliant with standards, whilst the impact of spares and obsolescence will only worsen over time. Defects and findings contravene NGT's ability to meet legislations further demonstrates that timely intervention is required.

5.1.47 Overall, this investment seeks to address these problems by efficiently delivering an integrated package of works across the whole of Unit 1A in line with the strategic aims of the programme.

5.1.48 Should the proposed interventions not be performed, impacts of failure become more likely and drive an increasing probability of unplanned unit operational stand down potentially negatively effecting UK security of supply.

How will we understand if the project has been successful?

5.1.49 The project will be deemed successful when all asset health works are completed, the unit is returned to service and demonstrates reliable service. Furthermore, once the scope has been delivered, the asset will comply to the relevant technical specifications, safety, and engineering standards.

5.1.50 Success will also be measured based on programme delivery including management of risks, budgets and schedules.

5.1.51 Additionally, NGT Management Procedure (T/PM/G/35) incorporates the philosophy and general principles outlined in the Institution of Gas Engineers and Managers (IGEM) standard IGEM/GL/5 Edition 2 'Managing new works, modifications and repairs' and serves to adopt its principles. Adherence to this will be demonstrated prior to the issuing of commissioning certificates as per NGT Policy (RE/18) and the asset being handed back to the operator.

Spend Boundaries

5.1.52 This paper covers asset health interventions on Unit 1A at the St. Fergus Gas Terminal across mechanical, electrical and structural assets.

5.1.53 The proposed investments are directly linked to defects and improvements identified as part of Asset Health survey reviews conducted by NGT and its MWC.

5.1.54 This funding request does not cover installation of three new units as this, as previously mentioned, is covered under a separate EJP.

5.1.55 During asset health surveys, the MWC identified several items related to Unit 1A which were already included in the RIIO-GT3 business plan. Where these items were approved by Ofgem in the Final Determination, they have been explicitly excluded from the scope of this paper.

5.1.56 For items where Ofgem's Final Determination provided no allowance, and the MWC/SME reports presented new evidence warranting reconsideration, these interventions have been included in this program to safeguard Unit 1A's availability post 2030.

5.1.57 Appendix A column H within tabs St. Fergus Mechanical Assets and St. Fergus Electrical Assets provides further detail on the interaction between this EJP and the RIIO-GT3 business plan submission.

6 Options Considered

6.1.1 Figure 35 provides a high-level summary of the steps taken to derive and assess options to address the issues presented in the Problem Statement section in this paper.

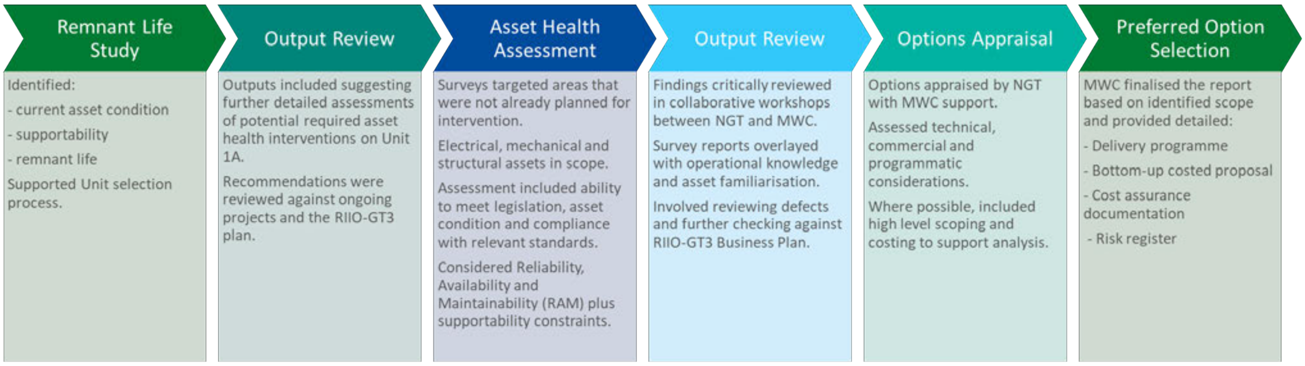


Figure 36: High Level Optioneering Process

6.1.2 NGT adopted a rigorous and structured optioneering process to ensure that multiple potential solutions were explored within the constraints of the project. This multi-staged approach aimed to ensure that decisions were technically sound and strategically aligned with the project objectives and site strategy.

6.1.3 The process involved:

- Comprehensive issue analysis at asset-level detail based on detailed surveys.
- Leveraging the expertise of specialist contractors and delivery partners, combined with operational knowledge from site personnel and subject matter experts across NGT.
- Collaborative workshops between NGT and the Main Works Contractor (MWC) to critically review recommendations against both technical and commercial criteria.
- Integration of defect data, gap analysis, and equipment supportability constraints to ensure robust decision-making.

6.1.4 By exploring multiple methods to address key drivers such as legislative compliance, adherence to standards, and mitigation of HSE risks, the optioneering process also considered system interactions, process dependencies, and alignment with ongoing projects.

6.1.5 For each candidate option considered, further analysis was undertaken to assess the advantages and disadvantages and what the scope of interventions would likely entail. In turn, this process enabled high-level comparisons of anticipated costs where possible.

6.1.6 The outcome is captured in the Intervention Portfolio (Appendix A) which provides a transparent evaluation framework detailing why certain options were selected and others discounted, along with clear linkage between proposed interventions, known issues, and long-term strategic objectives.

6.1.7 The Intervention Portfolio provides rationale based on criteria including:

- Intervention drivers
- Dependencies
- Survey findings and SME inputs
- Site intelligence and Computerised maintenance management system (CMMS) defect data

6.1.8 This structured methodology demonstrates that multiple options were appraised across a range of drivers to ensure that the final recommendations represent the optimum balance of safety, compliance, cost-effectiveness, and strategic fit.

6.1.9 The tables below provide a high-level summary of the option taken forward for each asset. Appendix A provides rationale for why options were either discounted or selected.

[redacted]

[redacted]

[redacted]				

[redacted]

6.1.10 Table 7 and Table 8 in conjunction with intervention portfolio document show optioneering for the assets which currently serve Unit 1A.

6.1.11 Table 9 includes works for which optioneering was not feasible. For these items, NGT identified the most appropriate approach through separate BAT assessments/reports. These interventions were excluded from Interventions portfolio -detailed optioneering (Appendix A) as they involve new works rather than refurbishment or replacement. They relate to cases requiring new assets or further assessments to ensure compliance with key regulatory requirements.

Sl.No	Additional Work/New Asset	Details of Intervention
1	**Fuel Gas PRA and associated pipework**	**Fuel Gas PRA:** The problems and the need as discussed within section 5.1.21 to ensure reliable and efficient operation of the Unit, a dedicated PRA is required. This new PRA must be specifically sized to meet the fuel gas demand, avoiding operational inefficiencies and ensuring stable pressure control. Positioning the dedicated PRA adjacent to the existing Unit 1A fuel gas piping will minimize complexity and optimize integration with the existing system. **PRA Pipework:** Issues stated within 5.1.21 and 5.1.22 require new fuel gas piping route to connect the 36'' discharge header to the dedicated PRA and then to Unit 1A. **C-157: St. Fergus Fuel Gas heating modification volumes within RIIO-GT3 Business plan** included [redacted] Ofgem approved an allowance for this work within Final determination. **The Intervention proposed within this submission** includes the pipework from [redacted] this pipework will be required for the completion of this project. NGT carried out a comprehensive BAT assessment for this work detailed within section 7 of Appendix F.
2	**Fuel Gas Heater**	Section 5.1.22 details issues with Fuel gas temperature. To address these issues, [redacted] eeds to be installed locally near Unit 1A CAB. This heater will ensure that the fuel gas temperature remains sufficiently high before entering the gas turbine. NGT carried out a comprehensive BAT assessment for this work detailed within section 7 of Appendix F .
3	**GT Dehumidification system**	As covered in section 5.1.30. Unit 1A is non-compliant with the requirements of standard T/SP/COMP/33 that requires gas turbines to be fitted with a dehumidification system where the units can be on standby for extended periods.
4	**GT Blade-off Protection**	As covered in section 5.1.31. Unit 1A is currently non-compliant with the requirements stated within T/SP/COMP33, blade-off protection is required to protect the unit from catastrophic rotor failure.
5	**Gas Turbine /Compressor foundation assessment**	As covered in section 5.1.32. To confirm GT/compressor foundation's condition, a [redacted] This approach will confirm the underlying condition of Unit 1A's foundation without destructively testing an operational asset. The testing will ensure any necessary repairs are identified to maintain safe operation beyond 2030. Although an investment ID has been created to account for costs, [redacted]

Table 9: Additional Works/New Assets required on Unit 1A

7 Preferred Option and Project Plan

7.1.1 The option selection process identified candidate interventions and evaluated them using a comprehensive methodology to address survey findings and ensure compliance with relevant legislation and standards.

7.1.2 Based on these findings and recommendations from collaborative workshops, the preferred option is to deliver a programme of works across mechanical, electrical, and structural assets supporting Unit 1A. This aligns directly with the St Fergus Compressor Emissions – Final Preferred Option, which highlighted the need for significant asset health investment to improve unit availability.

7.1.3 Implementing targeted interventions - ranging from minor refurbishment to full replacement - will restore equipment integrity, maintain operational efficiency, and ensure safety standards are met in accordance with our obligations as a responsible operator. Together, this integrated package of works has been structured as a portfolio of activities that accounts for interdependencies, delivery constraints, and operational considerations.

7.1.4 Some interventions have been bundled to account for delivery practicalities. For example, [redacted] includes recoating of steel framework and member replacement, replacement of corroded interior and exterior acoustic panels, outer and inner access door replacements, roof renewal and drainage improvements, as well as inspecting and maintenance of inner CAB columns and baseplates.

7.1.5 Additionally, [redacted]. Bundling these scopes during the cladding removal will minimise outage durations, optimise resource mobilisation, and ensure compliance with legislation and regulations including HSWA,1974 and Control of Asbestos 2012 along with NGT standards for enclosure integrity and life extension.

7.1.6 Electrical works must also be aligned to ensure successful delivery. For example, cabling modifications during asset interventions will ensure compatibility and address issues holistically, mitigating performance and safety risks.

7.1.7 This approach will ensure that investment is delivered at the most efficient overall cost, however the need to deliver work within specific outage windows, procure specialist items from the supply chain, and coordinate with in-flight and upcoming projects creates a complex programme with substantial risk. Close collaboration with contractors will be essential to implement mitigation measures as necessary and maintain careful management throughout.

7.1.8 Overall, the preferred option is to deliver a programme of interventions to resolve known failures, performance deficiencies, and non-conformances across Unit 1A. This will enable continued safe and reliable operation, maintain network resilience, and minimise unplanned outages and whole-life costs.

Project Scope

7.1.9 The project scope follows the preferred option, with the interventions forming the basis of the volumes detailed in this section. The work scope includes:

- Design, Specification, and procurement of appropriate replacement sub-assets in accordance with NGT and relevant standards.
- Programming and coordination of works with coinciding site activities.
- Temporary works including civils and groundworks.
- Removal and replacement of life expired and defective sub-assets where replacement is necessary to provide the required life extension.
- Refurbishment of defective assets, where refurbishment provides the required life extension.
- Welding and Non-Destructive Testing (NDT) activities
- Site Acceptance Testing.
- Commissioning works.
- Reinstatement works.
- Collation and archiving of handover spares and records.
- Records and asset data updates.

Asset Health Investment IDs

7.1.10 NGT proposes to use the new Intervention IDs shown in . This is aligned with our re-opener request to apportion out the costs for all works proposed within this program.

7.1.11 The replacement Investment IDs cover investments where option for replacement of asset was taken forward as a preferred option, major refurbishment Investment IDs cover a bundle of component replacement and refurbishment [redacted] includes component replacement and component refurbishment/repair where applicable. Scope of each Investment ID within Table 10 and Table 11 is detailed within Appendix A tab 'St.Fergus Unit 1A Interventions'.

7.1.12 The population breakdown of volumes as per refurbish, replacement and installation of new assets is given as a breakdown in the table below:

[redacted]

7.1.13 The above table notes the replacement volumes are driven by electrical works majorly where refurbishment was not an option due to the reasons stated within the intervention portfolio document (Appendix).

[redacted]

Project Timescales

7.1.14 The project was sanctioned at [redacted] in December 2024 and detailed Asset Health surveys were completed in September 2025 when concrete testing of the foundation pile cap was carried out and the results were awaited. The project progressed to [redacted] November 2025 to ratify the outcome of the Asset Health scoping, cost estimation [redacted] and delivery programme which forms the basis of this cost submission.

7.1.15 Following Ofgem's determination, a contract will be let with [redacted] (See below section 8.1.17 for more details on NGT's contracting strategy). [redacted] in August 2026 which will cover feasibility, detailed engineering and procurement of long-lead items. The first phase of the contract will span from [redacted] The second stage of contract will be let for the construction stage at the end of detailed engineering, and before 2029 outage, circa February 2029. [redacted] will be required to revalidate the construction cost following the completion of the detailed engineering. The second phase of the contract will span from [redacted], with project closure in June 2032 based on the extensive and time-consuming records update and financial reconciliation associated with this large-scale project. Should agreement not be reached with [redacted] at the end of phase 1, NGT has the option to spot tender stage 2 delivery.

7.1.16 Table 11 below outlines the milestones and indicative timeline for delivering the project across RIIO-T2 ,RIIO-GT3 and RIIO-GT4, whilst Table 12 outlines An indicative delivery programme is included in Appendix G and the outage plan in Appendix H.

[redacted]

[redacted]

FY25				[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]				
	[redacted]			
		[redacted]		
		[redacted]		
		[redacted]		

[redacted]

7.1.17 '*' directs to Activity S/No mentioned in Table 11

Final costs

7.1.18 [redacted], as the appointed Main Works Contractor (MWC), brings proven experience in engineering, construction, and commissioning for similar projects across other MCPD affected sites.

7.1.19 Leveraging this capability to ensure the robustness of costs, NGT engaged the MWC to validate scope, address engineering challenges, refine details, and develop an externally priced estimate aligned with market expectations for works of this nature.

7.1.20 The challenge and review process and how NGT arrived at an efficient cost estimate is further detailed within section 8 of this paper.

7.1.21 Table provides a breakdown of the final EAC costs for the project split by required categories.

[redacted]

[redacted]

7.1.22 The cost accuracy at this stage of the project is estimated at [redacted] in accordance with the Infrastructure and Projects Authority (IPA) cost estimating guidance. The investment and works will span across the RIIO-T2, RIIO-GT3 (construction and commissioning), and RIIO-GT4 (records update and closure) periods.

Key Business Risks and Deliverability Challenges

7.1.23 As expected with a project of this nature – characterised by complex interdependencies, operational constraints, and supply chain interactions – there are significant risks involved with delivering this portfolio of work. To ensure risks are understood and controlled appropriately, NGT utilise a robust management framework and programme governance methods as described in Appendix C chapter 3: Risk Methodology. Furthermore, detail of MWC risk management is provided in Appendix D.

7.1.24 The total risk value for asset health is [redacted] Table 14 presents the top three delivery risks, with the full descriptions of risks and associated potential impacts, qualitative and quantitative assessments and mitigations are detailed within the project Risk Register in Appendix B.

7.1.25 NGT is conscious that Ofgem generally applies a [redacted] risk cap; however, the wide ranging and extensive scope of asset health at St Fergus comes with high complexity, and more scope means more uncertainty. Through extensive risk reviews with internal and external specialist stakeholders, factoring in unique project complexity and uncertainties, detailed quantified risk registers were developed subject to Monte Carlo analysis resulting in a higher-than Ofgem's risk cap. St Fergus due to its coastal location is also subject to higher risk of delivery delays due to adverse weather compared with similar asset health projects at other NGT locations.

[redacted]

[redacted]

7.1.26 The following challenges are foreseen with other activities and interactions at the St Fergus Terminal which have been captured in the planning assumptions:

- Operationally critical maintenance activities – Maintenance activities that are undertaken at St. Fergus on fixed intervals driven by legislative requirements such as Pipeline Safety Regulations 1996 (PSR) and Pressure Systems Safety Regulations 2000 (PSSR) are fixed in the schedule as they cannot be moved.
- New Units project close-out activities might have an impact on the mobilisation activities for the Unit 1A Asset health program. The commencement of Plant 1 outage in April 2029 is contingent on the completion of the new units. By extension this has a direct impact on Unit 1A outage as Unit 1A is within Plant 1.
- All associated civils works require additional planning, temporary works, and a more complex strategy.
- All civils work will be conducted in accordance with all relevant safety standards. The dense population of buried services, plant and equipment leads to above ground complications with heavy machinery.
- Emerging scope leading to additional works required.

7.1.27 Despite the challenges detailed above, NGT has completed a series of deliverability assessments to confirm the scope is deliverable within the planned program. See Table 11 above for outline milestones and Appendix G for the St. Fergus MCPD Asset Health indicative delivery program for further details.

7.1.28 Deliverability has also been aligned to the RIIO-GT3 plan, and other adjacent work and customer outages.

7.1.29 Outages have been secured for delivery of the Unit 1A asset health, with close engagement required with NGT System Operations (SO) to adapt our planning to meet both changes in operational requirements and ensure successful project delivery inside agreed timescales.

7.1.30 The delivery programme is based on level 3 programmes from our MWC, combined with our internally estimated timescales based on similar projects already delivered, and confirmed outages.

Opportunities

7.1.31 In addition to identifying and implementing effective risk mitigation strategies, we recognise the importance of proactively identifying and capitalising on opportunities to enhance project value and achieve optimal outcomes.

7.1.32 We are committed to a strategic approach that prioritises the exploration and realisation of potential efficiencies, innovations and synergistic collaborations on the St. Fergus MCPD project. This approach is designed to ensure that the project not only meets its core objectives but also maximises its potential to deliver long-term benefits for our customers and consumers.

7.1.33 Integral to our opportunity realisation strategy is the application of value engineering principles. We will regularly review project components to identify cost-effective alternatives that could maintain or enhance functionality and performance of our compressor fleet throughout the lifecycle of the projects and continuously pursue emerging opportunities including those identified through value engineering exercises. By following this approach, we aim to translate identified opportunities into tangible benefits, contributing to the overall success of the project.

8 Cost Build up and Estimation Methodology

8.1.1 Funding was granted to undertake feasibility, a conceptual study and develop the options to determine the preferred solution. The spend to date has been quantified within the St. Fergus Cost Book (Appendix B).

8.1.2 To ensure robustness of costs, NGT employed the use of Designers / Main Works Contractors (MWCs) to validate scope, understand engineering challenges, and build an externally priced estimate reflecting current market costs.

8.1.3 Following a competitive process in which various Contractors were invited to tender, the rates were negotiated for three regions across the UK. [redacted] are assessed as competitive and qualified Contractor for the nature of this project.

8.1.4 The cost estimates are based on tendered prices i.e. they are based on bottom-up approach provided by an experienced MWC, using tendered pricing from designers, equipment and material suppliers, and internal estimates for people, plant and machinery. The contractor's estimate confidence level is further detailed in the Contractor Cost Methodology Report (Appendix D).

Estimating Uncertainty (EU)

8.1.5 In line with the Infrastructure and Projects Authority (IPA) cost estimating framework, the cost estimate has been structured around the fundamental equation: Base Estimate + Estimating Uncertainty + Risk = Anticipated Final Cost. The EU range selected was based on a Class estimate maturity, with a range of [redacted] applied. Our Cost and Risk Report (Appendix C) further detail the methodology for calculating the EU on this project.

8.1.6 Our Cost and Risk Report outline the cost and risk methodology used to establish a comprehensive and transparent framework for the project's financial planning and risk management. It delineates the systematic approach used to develop our cost estimates for this project.

Efficient Cost

8.1.7 The MWC produced detailed asset health surveys, which were conducted through the last stage of feasibility. Outputs from MWC, including cost estimation and delivery programme are included within our preferred option.

8.1.8 Following internal review of the MWC surveys reports and recommendations, the preferred option scope was confirmed. For some sub-assets, such as pipework, the scope was revised from minor to major refurbishment after inspections showed the asset condition was worse than initially assessed, and minor refurbishment intervention would not have met compliance or reliability requirements.

8.1.9 Based on the confirmed scope, the MWC produced a bottom-up cost estimate including quotations from the supply chain for detailed engineering, equipment and materials purchase, and internal estimation for labour and plant for the Construction and Commissioning phases.

8.1.10 To assure the MWC cost estimates, the activity pricing schedule provided by the MWC has undergone a cost assurance exercise. Key activities included cross checking Material Take-off (MTO) quantities and rates for materials, reviewing durations and resources for both construction activities and design phases to ensure alignment with both the programme of works and project requirements.

8.1.11 Specifications of fittings and pipework to be procured by the MWC have also been checked as suitable. To ensure that all costs have been allowed for by the MWC, a Document Review Sheet (DRS) was produced by NGT and issued to the MWC highlighting areas of concern or where clarification was required. This has resulted in a revised activity pricing scheduled incorporating the comments and queries raised to clarify points such as granularity of costs, scope limits and resource allocations.

8.1.12 Through this additional information, durations of activities and detail of allowances were able to be checked against scope activities. The resource forecast provided by the MWC provides additional cost assurance that sufficient project management allowances have been made. Where quantity errors have been found, these have been adjusted/reduced in alignment with resource durations. [redacted]

8.1.13 All quotes from the MWC have been included in the Contractor Cost Methodology Report (Appendix D) including a resource phasing forecast.

8.1.14 NGT costs (staff and operations resourcing) required to support successful project delivery has been built-up using the Contractor's delivery programme. This programme defines when the key project delivery milestones will take place and to determine the optimum / efficient resources required to support each stage. Resourcing has been identified through several key sources:

- Assessment of governing specifications and standards (e.g. BP/133G) defines core project delivery roles and responsibilities.

- Cross comparison against the resources utilised on similar asset health projects (i.e. Bacton and St Fergus terminal asset health projects).
- Lessons learnt from historic delivery projects (i.e. Bacton and St Fergus terminal asset health projects).
- Engagement with various disciplines within across our core departments (Asset, System Operator, Construction and Operations).

8.1.15 Staff utilisation throughout key project phases (detailed engineering, construction, commissioning, documentation handover/closure) was determined by the interrogation of:

- The Contractor's programme for Formal Process Safety Assessment (FPSA) workshops such as HAZOPs (Hazard and Operability Study), HAZCON (Hazard in Construction) etc. which are resource intensive particularly for engineering subject matter experts.
- The Contractor's construction programme which identifies the number of work areas to be supervised, the number of work crews proposed by the Contractor, the presence of any weekend working (the Contractor will work a 10-day rotation). This helped us determine the requirement for more than one project supervisor or safety advisor.

8.1.16 Supporting narrative on NGT direct roles and their project responsibilities are contained within Appendix A of the cost book (Appendix B). Please refer to the NGT Cost tab of the cost book for more granular cost detail.

Contracting Strategy

8.1.17 The delivery stage works associated with this submission for asset health works on Unit 1A will be packaged in a [redacted] type approach on the [redacted].

8.1.18 This contract type was selected, following market consultation with [redacted] to enable early collaboration and engagement with the Contractor to prioritise scope definition and cost estimate development ahead of the re-opener submission. This ECI approach reduces risk, enhances collaboration, and ensures timely delivery. Bringing the contractor into the early design and planning phases allows for their input ahead of construction which contributes to cost efficiencies through design optimisation, constructability, risk management, and stakeholder alignment.

8.1.19 The [redacted], which limit collaboration and hinder innovation during early stages of project development, which often leads to changes late in the design process with significant increase in cost and project delays.

8.1.20 [redacted] forming the basis of this submission.

8.1.21 The [redacted] detailed engineering and long lead procurement on a [redacted], with an indicative tender price for [redacted] construction, commissioning and close out. At the completion of [redacted] the MWC will update their tender for [redacted]. Should agreement not be reached for [redacted] e.g. costs exceed gross allowances, NGT has the option to [redacted] construction, commissioning and close out.

Unit 1A Asset Health- St. Fergus compressor re-opener cost movement from FOSR

8.1.22 In the FOSR submission, various solutions to achieve MCPD compressor emissions compliance were identified and evaluated. This included a broad range of technological, operational and commercial options to derive the shortlist of options and cost estimate to an accuracy of [redacted]. The main purpose of the estimate of circa [redacted] was to support the commercial evaluation and comparison of the proposed options, rather than to define a fully developed delivery scope.

8.1.23 The FOSR costs reflected high-level assumptions that existing SGT-A20 Avon units operating under Emergency Use Derogation (EUD) post-2030 would require periodic major overhauls and essential maintenance interventions. The estimate assumed auxiliary systems such [redacted]

8.1.24 Since the FOSR submission, a combination of findings from detailed asset health surveys, defect reviews and feasibility studies has contributed to significant variance in costs when compared to the original estimate. These changes reflect the maturity of scope definition and the need to address asset condition issues to ensure safe and reliable operation of Unit 1A under derogated service. Key factors include:

- **Additional Scope:** The Civils and Painting element of scope was not included in the FOSR submission but was introduced following asset health surveys. Structural steelwork corrosion, degraded compressor acoustic building (CAB) and protective coating failures were identified, requiring a major CAB refurbishment/replacement package and associated ducting and foundation works.

- Post-survey reviews between our subject matter experts and the Main Works Contractor (MWC) revealed a need to revise assumptions made at FOSR stage. For example, initial assumptions for major refurbishment of valves and actuators have been upgraded to full replacement due to severe wear, obsolescence and safety concerns (as discussed in previous sections).
- **Additional Scope:** Post-FOSR surveys confirmed new essential scope that was not anticipated initially. Most significant is the replacement of critical electrical and auxiliary systems: Lube oil system replacement (pumps, coolers, filters), Fuel gas heating system replacement due to fuel gas temperature issues leading to non-availability of the Unit, fire suppression system being non-compliant with evolving standards, Compressor dehumidification and GT blade-off protection required as a part of complying with standards, Significant Arc-flash risks leading to complete replacement of critical electrical switchboards which were not scoped initially.
- **Materials:** Material costs have increased overall due to expanded scope and the transfer of procurement responsibility from NGT direct to the MWC to ensure accountability and risk management clarity. Market price escalation since RIIO-T2 baseline further compounds cost growth**.**
- **Main Works Contractor Costs –** These costs have increased as the scope has been revalidated and programmed for delivery. Integration of new auxiliary system replacements, civils works, and pipework refurbishment has extended the programme duration and increased preliminaries and mobilisation costs. Contractor risk and escalation allowances are now explicitly included.
- **Direct Company Costs –** Direct costs have increased in line with the revised duration of works and the corresponding increase in MWC costs for the same reason.
- **Engineering Design –** Conceptual engineering for mechanical and electrical asset health interventions has been adjusted to reflect the expanded scope and complexity introduced by auxiliary system replacements and civils integration.
- **Project Management –** Overall duration of the project has increased from the original FOSR submission as the delivery programme is now mature, with phasing of works over two outages in consecutive years confirmed following a deliverability assessment.
- **Risk and Contingency –** The overall risk provision is now approximately [redacted] of total cost and within appropriate coverage for this scope of work. The additional level of detailed work undertaken allowed more robust updates to be made to the QRA, which ultimately drives this cost element.

8.1.25 Whilst overall costs have increased significantly, it should be noted that several factors such as market price increases, appropriate risk allocation, revised intervention categories and the addition of substantial new scope due to asset condition have reasonably contributed to the current cost position. The movement from FOSR stage to [redacted] EAC) now (2018/19 price base) is explained by scope discovery through surveys and feasibility, brownfield delivery realities (i.e. where practical challenges and constraints occur while dealing with interactions with live assets) and formal risk treatment rather than arbitrary cost escalation.

8.1.26 This option remains rooted in the original FOSR intent ensuring Unit 1A can operate safely and reliably under derogated conditions to provide resilience and maintain gas supply at required volumes and pressures. The revised scope addresses critical asset health risks and compliance obligations, delivering best value to consumers through proactive intervention rather than reactive failure management.

9 Conclusion

9.1.1 This report has explained the approach NGT has taken to review and conclude the Asset Health interventions required for compressor Unit 1A at the St Fergus gas Terminal to enable it to operate reliably to 2050, and the implications of not completing these works.

9.1.2 Furthermore, it has detailed the safety, environmental and operational risk concerns NGT has regarding the defective and life expired mechanical and electrical sub-assets and the implications of these on the reliability of Unit 1A. The interventions are necessary to ensure improved reliability and life extension of the unit.

9.1.3 The proposed scope is in line with the Ofgem's approved FOSR option and meets internal SME and external contractor engineering approval.

9.1.4 The project's agreed scope and cost have been assured for efficiency. The scope has been assessed against the current electrical, structural and mechanical standards, while the costs have been assured by benchmarking against similar projects delivered.

9.1.5 Failure to obtain funding will put Unit 1A at risk of continued failure and operational stand down, potentially leaving St Fergus Gas Terminal vulnerable and unable to meet its reliability and availability commitments on the National Transmission system.

9.1.6 Failure to address the issues could result not only in a loss of reliable gas supply for consumers but also in forcing NGT and site personnel to operate critical equipment that is already well beyond its design life. This significantly increases the risk of a serious incident (personnel injury, loss of containment etc.), which could expose NGT to enforcement action or prosecution by regulatory bodies such as the HSE, the Environment Agency, and others.

9.1.7 The interventions described will provide the best value for money and support the gas delivery at pressures and volumes our customers require.

9.1.8 The funding request (CEPOt) for Asset Health interventions on Unit 1A at St Fergus Terminal totals [redacted]

10 Appendix

1. Appendix A - St. Fergus Asset Portfolio document
2. Appendix B - St. Fergus Unit 1A Asset health Cost Book
3. Appendix C - St Fergus Unit 1A Asset Health Cost and Risk Report
4. Appendix D - St Fergus Unit 1A Asset Health Contractor Cost Methodology
5. Appendix E - St Fergus Unit 1A Contractor Cost Estimate Report
6. Appendix F - St Fergus Unit 1A Asset Health Survey Report
7. Appendix G - St Fergus Unit 1A Asset Health Delivery Programme
8. Appendix H - St Fergus Unit 1A Outage Plan

10 Glossary

Glossary	
CBA	**Cost Benefit Analysis:** A mathematical decision support tool to quantify the relative benefits of each site option.
CDS	Conceptual Design Study
COMAH	Control of Major Accident Hazards (COMAH) Regulations 2015. St Fergus Terminal is one of two designated NGT COMAH establishments. The other being Bacton Terminal
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations 2002
EAC	**Estimated Cost At Completion:** A value expressed in money and/or hours to represent the projected final costs of work when completed.
ECI	Early Contractor Involvement
EJP	Engineering Justification Paper
Entry Capacity	Holdings give NTS users the right to bring gas onto the NTS on any day of the gas year. Capacity rights can be procured in the long term or through shorter term processes, up to the gas day itself. Each NTS Entry point has an allocated Baseline which represents a level of Capacity that NGT is obligated to make available for delivery against on every day of the year
EPC	Engineering Procurement and Construction
Exit Capacity	Holdings give NTS users the right to take gas off the NTS on any day of the gas year. Capacity rights can be procured in the long term or through shorter term processes, up to the gas day itself. Each NTS Exit point has an allocated Baseline which represents a level of Capacity that NGT is obligated to make available for offtake on every day of the year.
FES	**Future Energy Scenarios:** An annual industry-wide consultation process encompassing questionnaires, workshops, meetings and seminars to seek feedback on latest scenarios and shape future scenario work. The Future Energy Scenarios document is produced annually by National Grid ESO and contains their latest scenarios.
FOS	Future Operating Strategy
FOSR	Final Option Selection Report
GS(M)R	**Gas Safety (Management) Regulations:** The Gas Safety (Management) Regulations 1996 (GS(M)R) apply to the conveyance of natural gas (methane) through pipes to domestic and other consumers
HSE	**Health and Safety Executive**
IPA	**Infrastructure and Projects Authority**
LNG	Liquified Natural Gas, Natural gas that has been cooled to a liquid state (around -162ºC) and either stored and/or transported in this liquid form.
LAV	Locally Actuated Valves
MWC	Main Works Contractor

Glossary	
(G)NDP	**Network Development Process:** The process by which NGT identifies and implements physical investment on the NTS.
NEA	Network Entry Agreement
NEC	New Engineering Contract
NGT	National Gas Transmission
NTS	**National Transmission System:** The high-pressure system consisting of Terminals, compressor stations, pipeline systems and offtakes. Designed to operate at pressures up to 94 barg. NTS pipelines transport gas from Terminals to NTS offtakes.
OEM	**Original Equipment Manufacturer**
Ofgem	**Office of Gas and Electricity Markets:** The regulatory agency responsible for regulating Great Britain's gas and electricity markets.
PFD	**Process Flow Diagram**
PV	**Process Valves**
PSSR	Pressure Systems Safety Regulations 2000
RAM	**Reliability Availability Maintainability**
Re-opener	Re-openers are a type of RIIO uncertainty mechanism. Depending on their design, they allow Ofgem to adjust a licensee's allowances (in some cases up and in some cases down), outputs and delivery dates in response to changing circumstances during the price control period.
RIIO	**Revenue = Incentives + Innovation + Outputs**: RIIO-T2 is the second transmission price control review to reflect the framework; it sets out what the transmission network companies are expected to deliver and details of the regulatory framework that supports both effective and efficient delivery for energy consumers.
ROV	**Remote Operation Valves**
SOL	**Safe Operating Limit**
Uncertainty Mechanism	Uncertainty mechanisms exist to allow price control arrangements to respond to change. They protect both end consumers and licensees from unforecastable risk or changes in circumstances.
UKCS	**United Kingdom Continental Shelf:** The UK Continental Shelf (UKCS) is the region of waters surrounding the United Kingdom, in which the country has mineral rights. The UK continental shelf includes parts of the North Sea, the North Atlantic, the Irish Sea and the English Channel; the area includes large resources of oil and gas.
UID	Unique Identifier